

CLAIMS:

1           1. A method of manufacturing a cylinder head for a small engine comprising the steps  
2 of casting a cylinder head having an as-cast cylinder chamber defined by a cylinder wall, an as-  
3 cast spark plug aperture communicating with one end of said cylinder chamber, cooling fins, an  
4 exhaust port extending from the cylinder chamber to a first face on an exhaust post flange, an  
5 intake port extending from said cylinder chamber to a second face on an intake port flange,  
6 fastener openings in said first and second faces, a foot flange having an as-cast mounting surface  
7 at another end of said cylinder chamber, and having as-cast fastening apertures in said foot  
8 flange; machining said cylinder wall to a predetermined tolerance; and tapping said spark plug  
9 aperture.

1           2. A method of manufacturing a cylinder head according to claim 1, wherein said as-cast  
2 spark-plug aperture is closed at one end by a thin web and wherein said thin web is removed prior  
3 to tapping said spark plug aperture.

1           3. A method of manufacturing a cylinder head according to claim 1, wherein said  
2 exhaust port aperture and said intake aperture are closed by thin webs forming portions of said  
3 as-cast cylinder chambers and wherein said thin webs are removed when said cylinder wall is  
4 machined.

1           4. A method of manufacturing a cylinder head according to claim 1, wherein the flatness  
2 of the as-cast mounting surface of said foot flange is 0.006 inch over its entire surface.

1           5. A method of manufacturing a cylinder head according to claim 1, wherein said as-cast  
2 fastening openings in said foot flange are cast to a perpendicularity of 0.002 inch with respect  
3 to the foot flange mounting surface.

1           6. A method of manufacturing a cylinder head according to claim 1, wherein said as-cast  
2 fastening openings in said foot flange are cast to within 0.006 inch of a true positional location  
3 on said foot flange.

1 7. A method of manufacturing a cylinder head for a small engine comprising the steps  
2 of casting a cylinder head having an as-cast cylinder chamber defined by a cylindrical wall, an  
3 as-cast spark plug aperture communicating with one end of said cylinder chamber, cooling fins,  
4 an exhaust port extending from the cylinder chamber to a first face on an exhaust port flange, an  
5 intake port extending from said cylinder chamber to a second face on an intake port flange,  
6 fastener openings in said first and second faces, a foot flange having an as-cast mounting surface  
7 at another end of said cylinder chamber, and having as-cast fastening in said foot flange, said as-  
8 cast fastening openings in said foot flange being cast within 0.006 inch of a true positional  
9 location on said foot flange and being cast to a perpendicularity of 0.002 inch with respect to the  
10 foot flange mounting surface, said as-cast mounting surface of said foot flange being 0.006 inch  
11 over its entire surface; boring said cylinder wall to a predetermined tolerance; and tapping said  
12 spark plug aperture.

1 8. A method of manufacturing a cylinder head according to claim 7, wherein said as-  
2 cast spark-plug aperture is closed at one end by a thin web and wherein said thin web is removed  
3 prior to tapping said spark plug aperture.

1 9. A method of manufacturing a cylinder head according to claim 7, wherein said  
2 exhaust port aperture and said intake aperture are closed by thin webs forming portions of said  
3 as-cast cylinder chambers and wherein said thin webs are removed when said cylinder wall is  
4 machined.

1 10. A method of manufacturing a cylinder head according to claim 1, wherein apertures  
2 are cast in said fins, said apertures being axially aligned with the fastening apertures in said foot  
3 flange.

1 11. A method of manufacturing a cylinder head according to claim 1, wherein apertures  
2 are machined in said fins, said apertures being axially aligned with the fastening apertures in said  
3 foot flange.

1 12. A method of manufacturing a crankcase for a small engine comprising the steps of  
2 casting a crankcase having a crank chamber, a crankcase connecting flange defining an opening  
3 to said crank chamber, said crankcase connecting flange having an as-cast flange mounting  
4 surface, and having first and second fastener openings cast into said as-cast flange mounting  
5 surface, and threading said openings with self-threading fasteners.

1 13. A method of manufacturing a crankcase according to claim 12, wherein the flatness  
2 of the as-cast flange mounting surface is 0.006 inch over its entire surface.

1 14. A method of manufacturing a crankcase according to claim 12, wherein said first and  
2 second fastener openings are cast into said surface to a perpendicularity of 0.002 inch with  
3 respect to said surface.

1 15. A method of manufacturing a crankcase according to claim 12, wherein first and  
2 second fastener openings are cast to within 0.006 inch of a true positional location on said  
3 surface.

1 16. A method of manufacturing a crankcase according to claim 12, wherein an O-ring  
2 groove is cast into said surface to surround said opening, and wherein an O-ring is inserted into  
3 said groove.

1 17. A method of manufacturing a crankcase for a small engine comprising the steps of  
2 casting a crankcase having a crankcase chamber, first and second bearing recess at an end of said  
3 crankcase chamber, each recess being defined by a cylindrical sidewall having a plurality of  
4 rounded radially inwardly directed flutes formed thereon, and pressing a roller bearing into each  
5 recess.

1 18. A method of manufacturing a crankcase according to claim 17, wherein the flutes are  
2 evenly spaced about the cylindrical sidewalls and are separated by arcuate sidewall portions.

1 19. A method of manufacturing a crankcase according to claim 18, wherein the flutes in  
2 said first bearing recess are offset an arcuate distance with respect to the flutes in said second  
bearing recess.

1 20. A method of manufacturing a crankcase according to claim 19, wherein said arcuate  
2 distance corresponds to said arcuate dimension.

1 21. A method of manufacturing a crankcase according to claim 20, wherein the number  
2 of balls in said ball bearing do not equal the number of flutes in a bearing recess.

1 22. A method of manufacturing a crankcase according to claim 20, wherein the number  
2 of balls in said ball bearing are greater than the number of flutes in a bearing recess.

1 23. A method of manufacturing a crankcase according to claim 20, wherein there are eight  
2 balls in a ball bearing and seven flutes in a bearing recess.

1 24. A method of manufacturing a crankcase according to claim 17, wherein each roller  
2 bearing is pressed into each recess until it seats on said toroidal base.

1 25. A method of manufacturing and assembling a cylinder head and crankcase for a small  
2 engine comprising the steps of casting a cylinder head having an as-cast cylinder chamber  
3 defined by a cylinder wall, an as-cast spark plug aperture communicating with one end of said  
4 cylinder chamber, cooling fins, an exhaust port extending from the cylinder chamber to a first  
5 face on an exhaust port flange, an intake port extending from said cylinder chamber to a second  
6 face on an intake port flange, fastener openings in said first and second faces, a foot flange  
7 having an as-cast mounting surface at another end of said cylinder chamber, and having as-cast  
8 fastener apertures in said foot flange; machining said cylinder wall to a predetermined tolerance;  
9 tapping said spark plug aperture; casting a crankcase having a crankcase chamber, a crankcase  
10 connecting flange defining an opening to said crank chamber, said crankcase connecting flange  
11 having an as-cast flange mounting surface, and having first and second fastener openings cast  
12 into said as-cast flange mounting surface; positioning the as-cast mounting surface of said

13 cylinder head foot flange in face-to-face contact with the as-cast flange mounting surface of said  
14 crankcase so that the as-cast fastening apertures in the cylinder head foot flange are in axial  
15 alignment with the first and second fastener openings of said crankcase flange mounting surface;  
16 and fastening said cylinder head to said crankcase by threading said openings and apertures with  
17 self-threading fasteners.

1 26. A method of manufacturing a cylinder head according to claim 25, wherein said as-  
2 cast spark-plug aperture is closed at one end by a thin web and wherein said thin web is removed  
3 prior to tapping said spark plug aperture.

1 27. A method of manufacturing a cylinder head according to claim 25, wherein said  
2 exhaust port aperture and said intake aperture are closed by thin webs forming portions of said  
3 as-cast cylinder chambers and wherein said thin webs are removed when said cylinder wall is  
4 machined.

1 28. A method of manufacturing a cylinder head according to claim 25, wherein the  
2 flatness of the as-cast mounting surface of said foot flange is 0.006 inch over its entire surface.

1 29. A method of manufacturing a cylinder head according to claim 25, wherein said as-  
2 cast fastening openings in said foot flange are cast to a perpendicularity of 0.002 inch with  
3 respect to the foot flange mounting surface.

1 30. A method of manufacturing a cylinder head according to claim 25, wherein said as-  
2 cast fastening openings in said foot flange are cast to within 0.006 inch of a true positional  
3 location on said foot flange.

1 31. A method of manufacturing a cylinder head according to claim 25, wherein apertures  
2 are cast in said fins, said apertures being axially aligned with the fastening apertures in said foot  
3 flange.

1 32. A method of manufacturing a cylinder head according to claim 25, wherein apertures  
2 are machined in said fins, said apertures being axially aligned with the fastening apertures in said  
3 foot flange.

1 33. A method of manufacturing a crankcase according to claim 25, wherein the flatness  
2 of the as-cast flange mounting surface is 0.006 inch over its entire surface.

1 34. A method of manufacturing a crankcase according to claim 25, wherein said first and  
2 second fastener openings are cast into said surface to a perpendicularity of 0.002 inch with  
3 respect to said surface.

1 35. A method of manufacturing a crankcase according to claim 25, wherein first and  
2 second fastener openings are cast to within 0.006 inch of a true positional location on said  
3 surface.

1 36. A method of manufacturing a crankcase according to claim 25, wherein an O-ring  
2 groove is cast into said surface to surround said opening, and wherein an O-ring is inserted into  
3 said groove.